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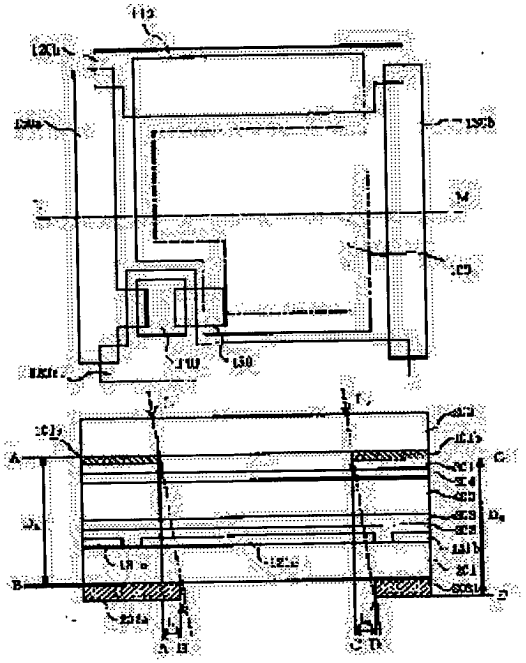
(54) LIQUID CRYSTAL PROJECTION TYPE DISPLAY

(57)Abstract:
PURPOSE: To improve the picture quality of a TFT (Thin-Film-Transistor) liquid crystal panel used for projection type television by decreasing the projection-side reflection factor of the liquid crystal panel and reducing unnecessary reflection caused with optical components.
CONSTITUTION: The liquid crystal panel consists of a glass substrate 200 on the side where TFTs are laminated, a glass substrate 201 which is provided opposite the glass substrate 200 and has BM laminated, pixel electrodes 131a, 131b, and 131c, a projection film 302, and an orienting film 303, a counter electrode 301, BM film 101a, 101b which are laminated on the glass substrate 200, an orienting film 304, and a liquid crystal layer 400 changed between orienting films 303 and 304; and the glass substrate 201 is coated with low-reflective films 202a and 202b.



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CLAIMS

[Claim(s)]
[Claim 1] The 1st glass substrate which forms the pixel electrode driven by TFT (henceforth, TFT). The 2nd glass substrate which forms the electrode which counters the pixel electrode of this 1st glass substrate. this — the liquid crystal panel which comes to enclose liquid crystal material with the gap of the 1st and this 2nd glass substrate The light source which carries out incidence of the light to the 2nd glass-substrate side of this liquid crystal panel. The 1st polarizer formed between the 2nd polarizer formed between this light source and this 2nd glass substrate, the lens which projects the light which penetrated the 1st glass-substrate side of this liquid crystal panel, and this 1st glass substrate and this projection lens. It is the liquid crystal projection type display equipped with the above, and is characterized by applying the film of a low reflection factor to the optical outgoing radiation side of this 1st glass substrate.
[Claim 2] The 1st glass substrate which forms the pixel electrode driven by TFT. The 2nd glass substrate which forms the electrode which counters the pixel electrode of this 1st glass substrate. this — the liquid crystal panel which comes to enclose liquid crystal material with the gap of the 1st and this 2nd glass substrate The light source which carries out incidence of the light to the 2nd glass-substrate side of this liquid crystal panel. The 1st polarizer formed between the 2nd polarizer formed between this light source and this 2nd glass substrate, the lens which projects the light which penetrated the 1st glass-substrate side of this liquid crystal panel, and this 1st glass substrate and this projection lens. It is the liquid crystal projection type display equipped with the above, and is characterized by applying the film of a low reflection factor to this 1st polarizing plate.
[Claim 3] The 1st glass substrate which forms the pixel electrode driven by TFT. The 2nd glass substrate which forms the electrode which counters the pixel electrode of this 1st glass substrate. this — the liquid crystal panel which comes to enclose liquid crystal material with the gap of the 1st and this 2nd glass substrate The light source which carries out incidence of the light to the 1st glass-substrate side of this liquid crystal panel. The 2nd polarizer formed between the 1st polarizer formed between this light source and this 1st glass substrate, the lens which projects the light which penetrated the 2nd glass-substrate side of this liquid crystal panel, and this 2nd glass substrate and this projection lens. It is the liquid crystal projection type display equipped with the above, and is characterized by applying the film of a low reflection factor to the field as for which the light of this 2nd glass substrate carries out outgoing radiation.

[Claim 4] The 1st glass substrate which forms the pixel electrode driven by TFT. The 2nd glass substrate which forms the electrode which counters the pixel electrode of this 1st glass substrate. this — the liquid crystal panel which comes to enclose liquid crystal material with the gap of the 1st and this 2nd glass substrate The light source which carries out incidence of the light to the 1st glass-substrate side of this liquid crystal panel. The 2nd polarizer formed between the 1st polarizer formed between this light source and this 1st glass substrate, the lens which projects the light which penetrated the 2nd glass-substrate side of this liquid crystal panel, and this 2nd glass substrate and this projection lens. It is the liquid crystal projection type display equipped with the above, and is characterized by applying the film of a low reflection

factor to this 2nd polarizing plate.
[Claim 5] The 1st glass substrate which forms the pixel electrode driven by TFT. The 2nd glass substrate which forms the electrode which counters the pixel electrode of this 1st glass substrate. this — the liquid crystal panel which comes to enclose liquid crystal material with the gap of the 1st and this 2nd glass substrate The light source which carries out incidence of the light to the 2nd glass-substrate side of this liquid crystal panel. The 1st polarizer formed between the 2nd polarizer formed between this light source and this 2nd glass substrate, the lens which projects the light which penetrated the 1st glass-substrate side of this liquid crystal panel, and this 1st glass substrate and this projection lens. It is the liquid crystal projection type display equipped with the above, and is characterized by preparing the 3rd glass substrate which applied the film of a low reflection factor between this 1st glass substrate and a projection lens.
[Claim 6] The 1st glass substrate which forms the pixel electrode driven by TFT. The 2nd glass substrate which forms the electrode which counters the pixel electrode of this 1st glass substrate. this — the liquid crystal panel which comes to enclose liquid crystal material with the gap of the 1st and this 2nd glass substrate The light source which carries out incidence of the light to the 1st glass-substrate side of this liquid crystal panel. The 2nd polarizer formed between the 1st polarizer formed between this light source and this 1st glass substrate, the lens which projects the light which penetrated the 2nd glass-substrate side of this liquid crystal panel, and this 2nd glass substrate and this projection lens. It is the liquid crystal projection type display equipped with the above, and is characterized by preparing the 3rd glass substrate which applied the film of a low reflection factor between this 2nd glass substrate and a projection lens.
[Claim 7] the [the liquid crystal panel which applied the aforementioned low reflective film in the claim 1 or any 1 term of 6, the 1st polarizing plate, the 2nd polarizing plate, or] — 3 board method liquid crystal projection type display characterized by changing using either of the 3 glass substrates
[Claim 8] the [the liquid crystal panel which applied the aforementioned low reflective film in the claim 1 or any 1 term of 6, the 1st polarizing plate, the 2nd polarizing plate, or] — the veneer method liquid crystal projection type display characterized by changing using either of the 3 glass substrates

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[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention is concerned with the liquid crystal panel used for projected type television, and a reflection factor is related with the composition of a low liquid crystal panel with the liquid crystal panel especially using TFT (Thin-Film-Transistor : TFT).
[0002]
[Description of the Prior Art] If a liquid crystal panel is divided roughly, it can divide into two kinds, a simple matrix liquid crystal panel and an active-matrix liquid crystal panel. The former is represented by the STN liquid crystal panel driven on both sides of the liquid crystal material of STN (Super-Twist-Nematic) by the simple electrode. The latter is represented by the TFT liquid crystal panel which drives the liquid crystal material of TN (Twist-Nematic) by ON/OFF switching of TFT (Thin-Film-Transistor : TFT). Although the direction of the latter TFT liquid crystal panel is excellent in quality of image, it is difficult to manufacture a large-sized liquid crystal panel. For this reason, development of projected type television which projects a large-sized screen using a TFT liquid crystal panel is performed briskly. The theoretic composition of the structure of this liquid crystal panel and projected type television using this is detailed on "the flat display 91" (Nikkei EREKUROTONIKUSU 1991).
[0003] Liquid crystal projection type TV has the feature that it is comparatively easy to make a screen bright, by enlarging the quantity of light of the light source small and lightweight. Since a projection screen will become dark inevitably if a projection screen is large-sized-ized, increasing the quantity of light of the light source in parallel is performed.
[0004] If the quantity of light of the light source is increased, the phenomenon in which become easy to produce the optical leak by the TFT which exists in the interior of a liquid crystal panel, and the brightness ratio (contrast ratio) of the black of the display screen and white falls will be seen. As this cure, the metal membrane of the gate is made large or area of a black matrix (henceforth, BM) is enlarged so that TFT may be shaded.
[0005]
[Problem(s) to be Solved by the Invention] Thereby, although the contrast fall by optical leak can be prevented, on the other hand, the unnecessary light reflex in a gate electrode or the metal side of BM increases, and it attracts the fall of the contrast in minute area. That is, on the screen on which white and black are intermingled, the light which penetrated the portion of the white of a liquid crystal panel will turn into the unnecessary reflected light, will jump into a part for a black display, and will spoil contrast remarkably.
[0006] There is not little unnecessary reflected light, when the light which penetrated the liquid crystal panel reflects by optics, such as prism and a projection lens, this light reflects in respect of the outgoing radiation of a liquid crystal panel again and it is not only generated inside a liquid crystal panel, but is generated. The reflected light which produces the unnecessary reflected light which has a bad influence on quality of image in respect of the outgoing radiation of this liquid crystal panel is most.
[0007] As for this unnecessary reflected light produced in respect of liquid crystal panel outgoing radiation, it is common by giving a multilayer coating tip to prism and a projection lens to lessen

the reflected light in an optic and to reduce it. Furthermore, a policy which constitutes the gate electrode of TFT and BM from a metal with a low reflection factor is also considered. However, it is a special metal with a metal with a low reflection factor difficult to etch, for example, a chrome oxide etc., and it is not completeness that treatment by the usual TFT formation process is not easy, and the reflected light in the glass interface of a liquid crystal panel remains etc. Therefore, the unnecessary reflected light produced in respect of the outgoing radiation of this liquid crystal panel was set to one of the obstacles which realizes high brightness and the screen of high contrast by the projected type liquid crystal display.

[0008]

[Means for Solving the Problem] In this invention, in order to reduce the reflection factor in the outgoing radiation side of this liquid crystal panel, by the pattern according to the opening configuration of a liquid crystal panel, and the degree of incident angle of light, on the glass substrate by the side of the outgoing radiation side of a liquid crystal panel, the low reflective film which is hard to reflect or it absorbs light is applied by printing or RISOGURAFU, and is formed. Or the glass and the polarizing plate which applied the above-mentioned low reflective film are stuck to the above-mentioned liquid crystal panel, and are arranged.

[0009]

[Function] The light reflected from optics, such as prism and a projection lens, is almost absorbed by the above-mentioned low reflective film. For this reason, even if the light which penetrated a part for a bright display locally [a liquid crystal panel] reflects with a projection lens, it does not become stray light but the influence of the unnecessary reflected light to other dark portions decreases. Therefore, the contrast of the display screen increases by leaps and bounds.

[0010]

[Example] Hereafter, the example of this invention is explained in detail using a drawing.

[0011] Drawing 1 is the optical block diagram of the liquid crystal projection type display using 3 board liquid crystal panel for the 1st example of this invention being shown.

[0012] It is the example of the optical system which used prism for - composition. the optical block diagram of drawing 1 — the spectrum of red-green blue (RGB) 3 color — the white light source 13, a reflecting mirror 12, and 3 colored light — a spectrum — prism 11 and the plane mirrors 15a and 15b for B — the plane mirrors 14a and 14b for R — and it distinguished by the suffix of red (R), green (G), and blue (B), respectively — It consists of the field lenses 5R, 5G, and 5B, the polarizing plates 3R, 3G, and 3B by the side of incidence, the low reflective films 2R and 2G, 2B, liquid crystal panels 1R, 1G, and 1B, polarizing plates 4R, 4G, and 4B by the side of outgoing radiation, 3 colored-light composition prism 10, and a projection lens 16.

[0013] A spectrum is carried out to three colors of RGB by prism 11. the white light from the light source 13 — a spectrum — R light, respectively Plane mirrors 14a and 14b, field lens 5R, polarizing plate 3R, It passes along the path of liquid crystal panel 1R, low reflective film 2R, and polarizing plate 4R. B light Plane mirrors 15a and 15b, Field lens 5B, polarizing plate 3B, liquid crystal panel 1B, low reflective film 2B, the path of polarizing plate 4B — a passage — G light — field lens 5G, polarizing plate 3G, and liquid crystal panel 1G — low — the path of reflective film 2G and polarizing plate 4G — a passage — the synthetic prism 10 — compounding — having had — after — projection — a lens — 16 — projecting — having .

[0014] Drawing 2 is the plan (a) and cross section (b) of a pixel for explaining the relation between the liquid crystal panels 1R, 1G, and 1B shown in drawing 1 , and the low reflective films 2R and 2G and 2B. The pixel of drawing 2 (a) consists of the drain wires 130a and 130b which supply a signal, the gates 120a and 120b which turn on TFT and are turned off, a-Si140 which constitutes the channel of TFT, a source electrode 150, a pixel electrode 110, and BM opening 100 of a pixel. The glass substrate 201 of the side which drawing 2 (b) is a cross section meeting the line LM of drawing 2 (a), and carries out the laminating of the TFT, The glass substrate 200 of the side which counters this glass substrate 201, and prepares, and carries out the laminating of the BM, The pixel electrodes 131a, 131b, and 131c which carry out a laminating to this glass substrate 200 and a protective coat 302, and the orientation film 303, It consists of the liquid crystal layer 400 enclosed between the BM films 101a and 101b which carry out a laminating to

this glass substrate 200 and the counterelectrode 301, the orientation film 304, and this orientation film 303,304, and the low reflective films 202a and 202b applied to this glass substrate 201.

[0015] In addition, after patternizing the method of applying coloring matter, such as a pigment system, by printing, and forming it as the formation method of the low reflective films 202a and 202b, or an optical binder with lithography and giving adhesiveness partially, there are a method of making the coloring matter of these pigment systems stick, and forming, the method of patternizing with lithography the resist film which mixed and applied the pigment, and forming it, etc. Since coloring matter is applied to the exterior of a liquid crystal panel by these methods, it is possible to choose the quality of the material of coloring matter etc., without taking into consideration the influence on TFT or liquid crystal material.

[0016] A beam of light shall carry out incidence from a glass-substrate 200 side, and a beam of light I1 represents I2 with the example shown in drawing 2 (b) with the beam of light with most frequency of the incident lights. A beam of light I1 touches the edge B of low reflective film 202a by the optical path by which arrangement of the low reflective films 202a and 202b passes along the edge A of BM film 101a, respectively, and it is made for a beam of light I2 to touch the edge D of low reflective film 202b by the optical path passing through the edge C of BM film 101b. That is, when the vertical distance between L2 and CD of those is set [the lap distance of BM film 101a and low reflective film 202a / the vertical distance between L1 and its AB] to D2 for the lap distance of D1 and BM film 101b, and low reflective film 202b, the incident angles theta1 and theta2 of beams of light I1 and I2 are [0017].

[Equation 1] Lk**tanthetakxDk (1 however, k= 2)

It is in ******. When incident angle theta1**5 degree and distance D1**0.7mm are used as an example in a projection display, it is about L1**60micro.

[0018] Although low reflective films 202a and 202b hardly affect it to the light which carries out incidence of the arrangement of this drawing 2 (b) from a glass-substrate 200 side, and passes opening with the BM films 101a and 101b, to the light which reflects from projection optical system etc. and carries out incidence from a glass-substrate 202 side, low reflective films 202a and 202b serve as an absorber, and it is effective in the ability to be able to reduce reflection of unnecessary light.

[0019] even when the low reflective films 202a and 202b are applied to a glass substrate 201 regardless of above several 1, it is effective in reducing reflection of unnecessary light — the low reflective films 202a and 202b serve as an absorber to the light which carries out incidence from a glass-substrate 200 side, and passes opening with the BM films 101a and 101b, and a substantial numerical aperture falls Therefore, these BM films 101a and 101b and the low reflective films 202a and 202b are similarity patterns, and it is effective in the ability to reduce unnecessary light easily by considering as physical relationship to which the edge of the pattern is equal. Furthermore, you have to change the physical relationship of the BM films 101a and 101b and the low reflective films 202a and 202b so that the degree of incident angle of an incident light may explain below strictly. Hereafter, the example of physical relationship in case the degrees of incident angle differ using drawing 3 - drawing 8 is explained.

[0020] The incident light of drawing 3 to a liquid crystal panel is convergence light., respectively The left end of a liquid crystal panel (L), The incident angle theta of the beams of light IL, IC, and IR in a center (C) and a right end (R) in the center of a liquid crystal panel thetaC (= perpendicular), It is the cross section of a liquid crystal panel for explaining an example of the physical relationship of the BM film 101-1 - 101-n, and the low reflective film 202-1 - 202-n about the example in the case of being thetaR at thetaL and a right end at the left end. in addition, about that from which a place differs by the same component Suffix 1-n by the number of an array pixel or a left end (L), a center (C), It distinguishes by the right end (R) suffix. about the former The BM film 101-1 - 101-n, Like the low reflective film 202-1 - 202-n, it wrote and was written as the glass substrates 201L, 201C, and 201R for TFT, or the glass substrates 200L, 200C, and 200R for BM about the latter.

[0021] In drawing 3 , the lap distance of the right end side AL of the BM film 100-1 and the right end side BL of the low reflective film 202-1 in a liquid crystal panel left end LL=|BL-AL|, The lap

distance of the left end side AC of BM film 100- (i+1) and the left end side BC of low reflective film 202- (i+1) in the center of a liquid crystal panel LC=|BC-AC|, Lap distance of the left end side AR of BM film 100-n at the right end of a liquid crystal panel and the left end side BR of low reflective film 202-n is made into LR=|BR-AR|, and the relation between incident angle thetaL of incident rays IL, IC, and IR, thetaC=90 degree, and thetaR is the following formula [0022].

[Equation 2]

Lk**tanthetakxDk (however, k=L, C, R)

******** -- the low reflective film 202-1 - 202-n are arranged like That is, since a beam of light IC carries out incidence perpendicularly in the center of a liquid crystal panel of drawing 3 , it is LC**0, and at the left end of a liquid crystal panel, it is BR-AR=LR>0 (the direction at the left end of [BR] low reflective film 202-n has overflowed) BL-AL=LL>0 (the right end BL of the low reflective film 202-1 has overflowed), and at the right end of a liquid crystal panel.

[0023] It is the end face of the low reflective film 202-1 - 202-n, or the BM film 101-1 - 101-n. In addition, the relation of end faces contrary to the above-mentioned publication, For example, "the relation of the left end side AC of BM film 100- (i+1) and the left end side BC of low reflective film 202- (i+1) in the center of a liquid crystal panel" to explanation of above-mentioned drawing 3 is received. "the relation between the right end side of BM film 100- (i+1) in the center of a liquid crystal panel, and the right end side of low reflective film 202- (i+1)" which is a relation of reverse end faces -- the ends of a liquid crystal panel -- removing -- the relation of a flash -- reverse -- a bird clapper -- drawing 3 -- obvious -- it is .

[0024] The incident light of drawing 4 is convergence light., respectively The left end of a liquid crystal panel (L), The incident angle theta of the beams of light IL, IC, and IR in a center (C) and a right end (R) in the center of a liquid crystal panel thetaC, It is the cross section of a liquid crystal panel for explaining the relation between the BM film 101-1 - 101-n, and the low reflective film 202-1 - 202-n about the example in the case of being thetaR (= perpendicular) at thetaL and a right end at the left end. In addition, the same number was attached about the same component part as drawing 3 .

[0025] Also in drawing 4 the lap distance of the right end side AL of the BM film 100-1 at the left end of a liquid crystal panel, and the right end side BL of the low reflective film 202-1 LL, The lap distance of the left end side AC of BM film 100- (i+1) of the center of a liquid crystal panel, and the left end side BC of low reflective film 202- (i+1) LC, Lap distance of the left end side AR of BM film 100-n at the right end of a liquid crystal panel and the left end side BR of low reflective film 202-n is set to LR. Incident angle thetaL of incident rays IL, IC, and IR, thetaC, and a thetaR=90 degree relation arrange the low reflective film 202-1 - 202-n, respectively, so that two above may be filled. That is, since a beam of light IR carries out incidence perpendicularly in the right end of drawing 4 , it is LR**0, and in the center, it is BL-AL=LL>0 (the right end BL of the low reflective film 202-1 has overflowed) in AC-BC=LC>0 (the direction at the left end of [AC] BM film 101- (i+1) has overflowed), and a left end.

[0026] In addition, an incident light is convergence light and the relation to right-and-left reverse shown by drawing 4 only becomes about the example in the case of carrying out incidence perpendicularly in a liquid crystal panel left end.

[0027] Drawing 5 is the cross section of a liquid crystal panel for explaining the relation between the BM film 101-1 - 101-n, and the low reflective film 202-1 - 202-n about an example in case the incident light to a liquid crystal panel is emission light, and the incident angle theta of the beams of light IL, IC, and IR in the left end (L) of a liquid crystal panel, a center (C), and a right end (R) differs from thetaL at a perpendicular and a left end, respectively and it differs from theta

[0028] Also in drawing 5 the lap distance of the right end side AL of the BM film 100-1 at the left end of a liquid crystal panel, and the right end side BL of the low reflective film 202-1 LL, The lap distance of the left end side AC of BM film 100- (i+1) of the center of a liquid crystal panel, and the left end side BC of low reflective film 202- (i+1) LC, Lap distance of the left end side AR of BM film 100-n at the right end of a liquid crystal panel and the left end side BR of low reflective film 202-n is set to LR. The relation between incident angle thetaL of incident rays IL, IC, and IR, thetaC=90 degree, and thetaR arranges the low reflective film 202-1 - 202-n,

respectively, so that two above may be filled. That is, since a beam of light IC carries out incidence perpendicularly in the center of a liquid crystal panel of drawing 5 , it is LC**0, and at the left end of a liquid crystal panel, it is AR-BR=LR>0 (the direction at the left end of [AL] BM film 101-N has overflowed) AL-BL=LL>0 (the right end AL of the BM film 101-1 has overflowed), and at the right end of a liquid crystal panel.

[0029] Drawing 6 is the cross section of a liquid crystal panel for explaining the relation between the BM film 101-1 - 101-n, and the low reflective film 202-1 - 202-n about an example in case the incident light to a liquid crystal panel is parallel light and each of incident angle thetaL of the beams of light IL, IC, and IR in the left end (L) of a liquid crystal panel, a center (C), and a right end (R), thetaL, and thetaR is 90 degrees, respectively.

[0030] Also in drawing 6 the lap distance of the right end side AL of the BM film 100-1 at the left end of a liquid crystal panel, and the right end side BL of the low reflective film 202-1 LL, The lap distance of the left end side AC of BM film 100- (i+1) of the center of a liquid crystal panel, and the left end side BC of low reflective film 202- (i+1) LC, If lap distance of the left end side AR of BM film 100-n at the right end of a liquid crystal panel and the left end side BR of low reflective film 202-n is set to LR An R= 90 degree [of incident angle theta L=theta C=theta of incident rays IL, IC, and IR] relation arranges the low reflective film 202-1 - 202-n, respectively, so that two above may be filled. That is, since it has set to the liquid crystal panel of drawing 6 and incidence also of the beam of light of a gap is carried out perpendicularly, it is LC**LL**LR**0, and the end face of the BM film 101-1 - 101-n, and the low reflective film 202-1 - 202-n is arranged so that all may gather mostly.

[0031] Although drawing 7 is parallel light with bad parallelism and the incident light to a liquid crystal panel carries out incidence perpendicularly as an average at the left end (L) of a liquid crystal panel, a center (C), and a right end (R), respectively It becomes the incident light of beams of light IL, IC, and IR from the drawing diagonal left, respectively. From the diagonal right, it is the incident light of beam-of-light IL', IC', and IR', respectively. the — dispersion — respectively — theta — L — theta — L — theta — R — and — theta — L — ' — theta — L — ' — theta — R — ' — it is — a case — an example — ******** — BM — a film — 101 — — — one — — — 101 — — — n — low — reflection — a film — 202 — — — one — — — 202 — — — n — a relation — explaining — a sake — a liquid crystal panel —

[0032] Also in drawing 7 the lap distance of the right end side AL of the BM film 100-1 at the left end of a liquid crystal panel, and the right end side BL of the low reflective film 202-1 LL, The lap distance of the left end side AC of BM film 100- (i+1) of the center of a liquid crystal panel, and the left end side BC of low reflective film 202- (i+1) LC, By setting lap distance of the left end side AR of BM film 100-n at the right end of a liquid crystal panel, and the left end side BR of low reflective film 202-n to LR, a relation with the incident angle of incident ray IL', and IC and IR arranges the low reflective film 202-1 - 202-n, respectively, so that two above may be filled. Namely, [0033]

[Equation 3] LK ** tanthetaK'x DK (however, k=L)

[0034]

[Equation 4]

Lk ** tanthetak x Dk (however, k=C, R)

The low reflective film 202-1 - 202-n are arranged so that it may become. This the relation of the end face of the BM film 101-1 - 101-n, and the low reflective film 202-1 - 202-n each — a right end — a field — a relation — ******** — the diagonal right — from — an incident ray — IL — ' — IC — ' — IR — ' — an incident angle — theta — L — ' — theta — L — ' — theta — R — ' — having used — the above — a number — three — following — About the relation of a left end side, it means following four above which used incident angle thetaL of the incident rays IL, IC, and IR from the diagonal left, thetaL, and thetaR. Consequently, it becomes the structure which also protrudes the end face of which BM film 101-1 - 101-n rather than the end face of the low reflective film 202-1 - 202-n.

[0035] Although drawing 8 is parallel light with bad parallelism and the incident light to a liquid crystal panel carries out incidence perpendicularly as an average at the left end (L) of a liquid crystal panel, a center (C), and a right end (R), respectively It becomes the incident light of

beams of light IL, IC, and IR from the drawing diagonal left, respectively. From the diagonal right, it is the incident light of beam-of-light IL', IC', and IR', respectively. the — dispersion — respectively — theta — L — theta — L — theta — R — and — theta — L — ' — theta — L — ' — theta — R — ' — it is — a case — an example — ******** — BM — a film — 101 — — one — — — 101 — — — n — low — reflection — a film — 202 — — — one — — — 202 — — n — a relation — drawing 7 — differing — an example — explaining

[0036] Also in drawing 8 the lap distance of the right end side AL of the BM film 100-1 at the left end of a liquid crystal panel, and the right end side BL of the low reflective film 202-1 LL, The lap distance of the left end side AC of BM film 100- (i+1) of the center of a liquid crystal panel, and the left end side BC of low reflective film 202- (i+1) LC, By setting lap distance of the left end side AR of BM film 100-n at the right end of a liquid crystal panel, and the left end side BR of low reflective film 202-n to LR, a relation with the incident angle of an incident ray IL, IC', and IR' arranges the low reflective film 202-1 - 202-n, respectively, so that two above may be filled. Namely, [0037]

[Equation 5] LK ** tanthetaK x DK (however, k=L)

[0038]

[Equation 6]

Lk ** tanthetak'x Dk (however, k=C, R)

It comes out. This the relation of the end face of the BM film 101-1 - 101-n, and the low reflective film 202-1 - 202-n Five above which used incident angle thetaL of the incident rays IL, IC, and IR from the diagonal left, thetaL, and thetaR about the relation of each right end side is followed. a left end — a field — a relation — ******** — the diagonal right — from — an incident ray — IL — ' — IC — ' — IR — ' — an incident angle — theta — L — ' — theta — L — ' — theta — R — ' — having used — the above — a number — six — following — things — meaning . Consequently, it becomes the structure which also protrudes the end face of which low reflective film 202-1 - 202-n rather than the end face of the BM film 101-1 - 101-n. The physical relationship of the end face of this low reflective film 202-1 - 202-n, and the BM film 101-1 - 101-n of the physical relationship shown in drawing 7 is reverse.

[0039] The explanation from above-mentioned drawing 2 to drawing 8 is an example at the time of using the liquid crystal panel of the structure in which light carries out incidence from the glass substrate 200 by the side of BM as shown in drawing 2 as liquid crystal panels 1R, 1G, and 1B of drawing 1 . Carrying out incidence from the glass substrate 201 by the side of TFT as incidence of light is also considered, and the example in this case is shown in drawing 9 .

[0040] Drawing 9 is the cross section of the pixel for explaining the relation between the BM films 101a and 101b in case optical incidence carries out incidence from the glass-substrate 201 side by the side of TFT, and the low reflective films 202a and 202b. The glass substrate 201 of the side which that of the component of drawing 8 is the same as that of drawing 2 (b), and carries out the laminating of the TFT, The glass substrate 200 of the side which counters this glass substrate 201, and prepares, and carries out the laminating of the BM, The pixel electrodes 131a, 131b, and 131c which carry out a laminating to the glass substrate 201 by the side of TFT and a protective coat 302, and the orientation film 303, Although it consists of a liquid crystal layer 400 enclosed between the BM films 101a and 101b which carry out a laminating to the glass substrate 200 by the side of BM and the counterelectrode counterelectrode 301, the orientation film 304, and this orientation film 303,304 The point which has applied to this glass substrate 200 the point and the low reflective films 202a and 202b in which beams of light I1 and I2 carry out incidence from the glass substrate 201 by the side of TFT differs from drawing 2 (b).

[0041] A beam of light I1 touches the edge of low reflective film 202a at the optical path by which arrangement of a low reflective film of 202a and 202b passes along the edge of BM film 101a, respectively, and it is made for a beam of light I2 to touch the edge of low reflective film 202b by the optical path passing through the edge of BM film 101b in the example shown in drawing 9 as well as drawing 2 . That is, if distance between L2 and CD of those is set [the lap distance of BM film 101a and low reflective film 202a / the distance between L1 and its AB] to D2 for the lap distance of D1 and BM film 101b, and low reflective film 202b, the incident angles

theta1 and theta2 of beams of light I1 and I2 will fill the above-mentioned several 1.
[0042] Drawing 10 is the cross section of the liquid crystal panel in which an example of the relation of the end face of the BM film 101-1 in the whole liquid crystal panel surface - 101-n, and the low reflective film 202-1 - 202-n which has the pixel structure shown in drawing 9 is shown. Although the component of drawing 10 is the same as drawing 3 - drawing 8 , only the points which the low reflective film 202-1 - 202-n have applied to the glass substrates 200L, 200C, and 200R by the side of BM differ.
[0043] The relation of the end face of the BM film 101-1 - 101-n, and the low reflective film 202-1 - 202-n in drawing 10 is an example in case the incident light to a liquid crystal panel is parallel light ideally, and is the same as the case of the incident light shown in above-mentioned drawing 6 . Similarly, the relation of explain [it / like drawing 3 - drawing 5 , drawing 7 , and drawing 8] of the end face of the BM film 101-1 - 101-n, and the low reflective film 202-1 - 202-n in case an incident light is not parallel light is clear.
[0044] Drawing 11 is the optical block diagram of the liquid crystal projection type display using 3 board liquid crystal panel for the 2nd example of this invention being shown. the optical composition which shows the optical block diagram of drawing 11 to drawing 1 — the same — the spectrum of red-green blue (RGB) 3 color — although it is the example of the optical system which used prism for - composition — the inside of drawing 1 — the white light source 13, a reflecting mirror 12, and 3 colored light — a spectrum — prism 11, the plane mirrors 15a and 15b for B, and the plane mirrors 14a and 14b for R were omitted and shown
[0045] In the example shown in drawing 11 , the auxiliary glass substrates 6R, 6G, and 6B were formed between liquid crystal panels 1R, 1G, and 1B and the polarizing plates 4R, 4G, and 4B by the side of outgoing radiation, and the low reflective films 2R and 2G and 2B are applied to these auxiliary glass substrates 6R, 6G, and 6B.
[0046] Drawing 12 is the cross section in which being the optical arrangement shown in drawing 11 , and showing an example of the relation of the end face of the BM film 101-1 - 101-n, and the low reflective film 202-1 - 202-n covering the whole liquid crystal panel surface. Although most of the component of drawing 12 is the same as that of drawing 3 - drawing 8 , only the points which the low reflective film 202-1 - 202-n have applied to the auxiliary glass substrates 206L, 206C, and 206R differ. In addition, these polarizing plates 204L, 204C, and 204R were also shown in the auxiliary glass substrates 206L, 206C, and 206R as that to which polarizing plates 204L, 204C, and 204R are also adhering.
[0047] It is an example in case an incident light is parallel light ideally also about drawing 12 , and the relation of the end face of the BM film 101-1 - 101-n, and the low reflective film 202-1 - 202-n is the same as the relation of the end face in the case of the incident light shown in above-mentioned drawing 6 . Similarly, the relation of the end face of the BM film 101-1 - 101-n, and the low reflective film 202-1 - 202-n in case an incident light is not parallel light is the same as that of drawing 3 - drawing 5 , drawing 7 , and drawing 8 .
[0048] Drawing 13 is the optical block diagram of the liquid crystal projection type display using 3 board liquid crystal panel for the 3rd example of this invention being shown. the optical composition which shows the optical block diagram of drawing 13 to drawing 11 — the same — the inside of drawing 1 — the white light source 13, a reflecting mirror 12, and 3 colored light — a spectrum — the optical structure which omitted prism 11, the plane mirrors 15a and 15b for B, and the plane mirrors 14a and 14b for R is shown
[0049] In the example shown in drawing 13 , the polarizing plates 4R, 4G, and 4B by the side of outgoing radiation were stuck on liquid crystal panels 1R, 1G, and 1B, and the low reflective films 2R and 2G and 2B are applied to these polarizing plates 4R, 4G, and 4B.
[0050] Drawing 14 is the cross section in which being the optical arrangement shown in drawing 13 , and showing an example of the relation of the end face of the BM film 101-1 - 101-n, and the low reflective film 202-1 - 202-n covering the whole liquid crystal panel surface. Although most of the component of drawing 12 is the same as that of drawing 3 - drawing 8 , polarizing plates 204L, 204C, and 204R are stuck on glass substrates 201L, 201C, and 201R, and the points which have applied the low reflective film 202-1 - 202-n to these polarizing plates 204L, 204C, and 204R differ.

[0051] It is an example in case an incident light is parallel light ideally also about drawing 14 , and the relation of the end face of the BM film 101-1 - 101-n, and the low reflective film 202-1 - 202-n is the same as the relation of the end face in the case of the incident light shown in above-mentioned drawing 6 . Similarly, the relation of the end face of the BM film 101-1 - 101-n, and the low reflective film 202-1 - 202-n in case an incident light is not parallel light is the same as that of drawing 3 - drawing 5 , drawing 7 , and drawing 8 .
[0052] Drawing 15 is the optical block diagram of the reflective method liquid crystal projection type display using the liquid crystal panel of three boards for the 4th example of this invention being shown. It differs from the composition of drawing 13 greatly in that the one-way mirror 7 which forms plane mirrors 8R, 8G, and 8B instead of the polarizing plates 3R, 3G, and 3B of drawing 13 , and separates the light from the light source 13 spectrally two times was newly formed although the part was similar to the optical composition which shows the optical block diagram of drawing 15 to drawing 13 . Namely, the half which separated the light from the light source 13 spectrally two times by the one-way mirror 7 carries out incidence to a dichroic prism 11, and a spectrum is carried out to the light of R, G, and B, among those R light passes along low reflective film 2R, polarizing plate 3R, and liquid crystal panel 1R, and after reflecting by the plane mirror 8, they carry out incidence to a dichroic prism 11 in a reverse path. The same is said of other G light and B light. In this way, after R light which has returned, G light, and B light are compounded by the synthetic prism 11, they pass a one-way mirror 7 and are projected with the projection lens 16.
[0053] The composition shown in drawing 15 is the structure where low reflective film 2R, low reflective film 2G, and low reflective film 2B were applied to polarizing plate 3R, polarizing plate 3G, and polarizing plate 3B like drawing 13 , respectively, and the physical relationship with the end face of the BM film 101-1 - 101-n, and the low reflective film 202-1 - 202-n is the same as that of explanation of drawing 14 .
[0054] Drawing 16 is the optical block diagram of the liquid crystal projection type display using the liquid crystal panel of the veneer for the 5th example of this invention being shown. The composition of drawing 16 consists of the light source 13, the reflective boundary 12, a polarizing plate 3, liquid crystal panel 1', and a polarizing plate 4, the low reflective film 2 and the projection lens 16. Although liquid crystal panel 1' differs from the liquid crystal panel 1 of monochrome which the point which is an electrochromatic display panel shows to above-mentioned drawing 1 - drawing 15 on the veneer projection type display of drawing 16 , it is the same as that of drawing 13 that it is the structure where the low reflective film 2 was applied to the polarizing plate 3, therefore the relation of physical relationship with the end face of the BM film 101-1 - 101-n, and the low reflective film 202-1 - 202-n is the same as that of explanation of
[0055]
[Effect of the Invention] By explanation of the example of the above this invention, by the pattern according to the opening configuration of a liquid crystal panel, and the degree of incident angle of light The low reflective film which is hard to reflect or it absorbs light on the glass substrate by the side of the outgoing radiation side of a liquid crystal panel is formed by printing or application. The light reflected from optics, such as prism and a projection lens, by sticking the glass and the polarizing plate which printed the above-mentioned low reflective film to the above-mentioned liquid crystal panel, and arranging them is almost absorbed by the above-mentioned low reflective film. Or a sake, Even if the light which a bright screen is partially shown in the display of a liquid crystal panel, and penetrated this portion may reflect with a projection lens, it does not become stray light but the contrast of ** and the display screen is [there is little influence of the unnecessary reflected light to other dark portions, and] effective in increasing by leaps and bounds.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the optical block diagram of the liquid crystal projection type display using 3 board liquid crystal panel for the 1st example of this invention being shown.
[Drawing 2] the effect of the example shown in drawing 1 is explained — it is the plan (a) and cross section (b) of a pixel of a sake
[Drawing 3] It is the cross section of the liquid crystal panel for explaining the physical relationship of BM film in case an incident light is convergence light in drawing 2 , and a low reflective film.
[Drawing 4] It is the cross section of the liquid crystal panel for explaining the physical relationship of BM film in case an incident light is convergence light in drawing 2 , and a low reflective film.
[Drawing 5] It is the cross section of the liquid crystal panel for explaining the physical relationship of BM film in case an incident light is emission light in drawing 2 , and a low reflective film.
[Drawing 6] It is the cross section of the liquid crystal panel for explaining the physical relationship of BM film in case an incident light is parallel light in drawing 2 , and a low reflective film.
[Drawing 7] It is the cross section of the liquid crystal panel for explaining the physical relationship of BM film in case an incident light is parallel light with bad parallelism in drawing 2 , and a low reflective film.
[Drawing 8] It is the cross section of the liquid crystal panel for explaining the physical relationship of BM film in case an incident light is parallel light with bad parallelism in drawing 2 , and a low reflective film.
[Drawing 9] It is the cross section of the pixel for explaining the relation between the liquid crystal panel in the case of carrying out optical incidence from the TFT side substrate, and a low reflective film.
[Drawing 10] It is the cross section of the liquid crystal panel for explaining the relation of the BM film of a liquid crystal panel and the low reflective film which have the pixel structure shown in drawing 9 .
[Drawing 11] It is the optical block diagram of the liquid crystal projection type display using 3 board liquid crystal panel for the 2nd example of this invention being shown.
[Drawing 12] It is the cross section of the liquid crystal panel for the relation between BM film and a low reflective film explaining with the liquid crystal panel of drawing 11 .
[Drawing 13] It is the optical block diagram of the liquid crystal projection type display using 3 board liquid crystal panel for the 3rd example of this invention being shown.
[Drawing 14] It is the cross section of the liquid crystal panel for the liquid crystal panel of drawing 13 explaining the relation between BM film and a low reflective film.
[Drawing 15] It is the optical block diagram of the reflective method liquid crystal projection type display using the liquid crystal panel of three boards for the 4th example of this invention being shown.
[Drawing 16] It is the optical block diagram of the liquid crystal projection type display using the

liquid crystal panel of the veneer for the 5th example of this invention being shown.

[Description of Notations]

13 — The white light source,
12 — Reflecting mirror
11—3 colored light — a spectrum — prism
15a, the plane mirror for 15 b—B,
14a, the plane mirror for 14 b—R,
5R, 5G, 5B — Field lens,
3R, 3G, 3B — Polarizing plate
2R, 2G, 2B — Low reflective film,
1R, 1G, 1B — Liquid crystal panel
4R, 4G, 4B — Polarizing plate
103 — Colored light composition prism,
16 — Projection lens,
130a, 130b — Drain wire
120a, 120b — Gate
140 — a-Si,
150 — Source electrode,
110 — Pixel electrode,
100 — BM opening,
200,201 — Glass substrate
131a, 131b, 131c — Pixel electrode,
302 — Protective coat
303 — Orientation film,
101a, 101 b—BM films,
301 — Counterelectrode
304 — Orientation film,
400 — Liquid crystal layer,
202a, 202b — Low reflective film,
101-1 - a 101-n—BM film,
202-1 - 202-n — Low reflective film.

[Translation done.]

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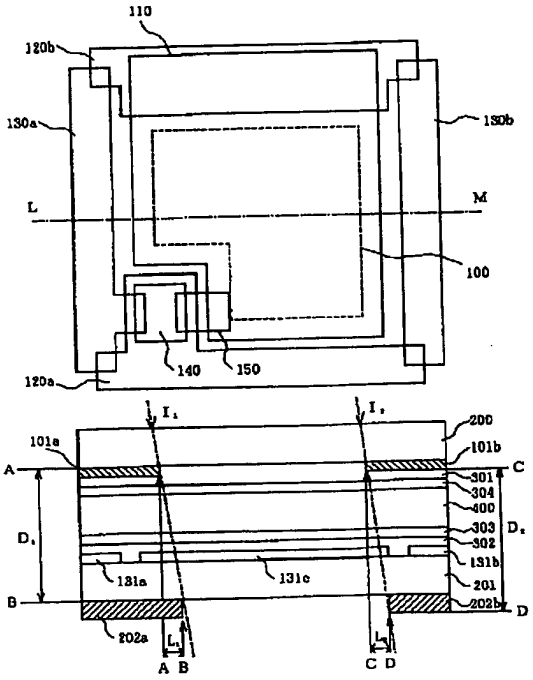
(54)【発明の名称】　液晶投写形ディスプレイ

(57)【要約】

【目的】投写形テレビジョンに用いるＴＦＴ（Thin－Film－Transistor:薄膜トランジスタ）液晶パネルにおける出射側反射率を低くし、光学部品との間で生じる不要反射を低減して画質の向上を図る。

【構成】ＴＦＴを積層する側のガラス基板２００と、該ガラス基板２００に対向して設けかつＢＭを積層する側のガラス基板２０１と、該ガラス基板２００に積層する画素電極１３１ａ，１３１ｂ，１３１ｃおよび保護膜３０２、配向膜３０３と、該ガラス基板２００に積層するＢＭ膜１０１ａ，１０１ｂおよび対向電極３０１、配向膜３０４と、該配向膜３０３，３０４の間に封入した液晶層４００とからなる液晶パネルにおいて該ガラス基板２０１に低反射膜２０２ａ，２０２ｂを塗布する。

図 2



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【特許請求の範囲】

【請求項１】薄膜トランジスタ（以下ＴＦＴ）で駆動される画素電極を形成する第１ガラス基板と、該第１ガラス基板の画素電極に対向する電極を形成する第２ガラス基板と、該第１および該第２ガラス基板の間隙に液晶材を封入してなる液晶パネルと、該液晶パネルの第２ガラス基板側に光を入射する光源と、該光源と該第２ガラス基板との間に設けた第２偏光子と、該液晶パネルの第１ガラス基板側を透過した光を投写するレンズと、該第１ガラス基板と該投写レンズとの間に設けた第１偏光子とからなる液晶投写ディスプレイにおいて、該第１ガラス基板の光出射面に低反射率の膜を塗布したことを特徴とする液晶投写形ディスプレイ。

【請求項２】ＴＦＴで駆動される画素電極を形成する第１ガラス基板と、該第１ガラス基板の画素電極に対向する電極を形成する第２ガラス基板と、該第１および該第２ガラス基板の間隙に液晶材を封入してなる液晶パネルと、該液晶パネルの第２ガラス基板側に光を入射する光源と、該光源と該第２ガラス基板との間に設けた第２偏光子と、該液晶パネルの第１ガラス基板側を透過した光を投写するレンズと、該第１ガラス基板と該投写レンズとの間に設けた第１偏光子とからなる液晶投写形ディスプレイにおいて、該第１偏光板に低反射率の膜を塗布したことを特徴とする液晶投写形ディスプレイ。

【請求項３】ＴＦＴで駆動される画素電極を形成する第１ガラス基板と、該第１ガラス基板の画素電極に対向する電極を形成する第２ガラス基板と、該第１および該第２ガラス基板の間隙に液晶材を封入してなる液晶パネルと、該液晶パネルの第１ガラス基板側に光を入射する光源と、該光源と該第１ガラス基板との間に設けた第１偏光子と、該液晶パネルの第２ガラス基板側を透過した光を投写するレンズと、該第２ガラス基板と該投写レンズとの間に設けた第２偏光子とからなる液晶投写形ディスプレイにおいて、該第２ガラス基板の光が出射する面に低反射率の膜を塗布したことを特徴とする液晶投写形ディスプレイ。

【請求項４】ＴＦＴで駆動される画素電極を形成する第１ガラス基板と、該第１ガラス基板の画素電極に対向する電極を形成する第２ガラス基板と、該第１および該第２ガラス基板の間隙に液晶材を封入してなる液晶パネルと、該液晶パネルの第１ガラス基板側に光を入射する光源と、該光源と該第１ガラス基板との間に設けた第１偏光子と、該液晶パネルの第２ガラス基板側を透過した光を投写するレンズと、該第２ガラス基板と該投写レンズとの間に設けた第２偏光子とからなる液晶投写形ディスプレイにおいて、該第２偏光板に低反射率の膜を塗布したことを特徴とする液晶投写形ディスプレイ。

【請求項５】ＴＦＴで駆動される画素電極を形成する第１ガラス基板と、該第１ガラス基板の画素電極に対向する電極を形成する第２ガラス基板と、該第１および該第

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２ガラス基板の間隙に液晶材を封入してなる液晶パネルと、該液晶パネルの第２ガラス基板側に光を入射する光源と、該光源と該第２ガラス基板との間に設けた第２偏光子と、該液晶パネルの第１ガラス基板側を透過した光を投写するレンズと、該第１ガラス基板と該投写レンズとの間に設けた第１偏光子とからなる液晶投写ディスプレイにおいて、低反射率の膜を塗布した第３ガラス基板を該第１ガラス基板と投写レンズとの間に設けたことを特徴とする液晶投写形ディスプレイ。

【請求項６】ＴＦＴで駆動される画素電極を形成する第１ガラス基板と、該第１ガラス基板の画素電極に対向する電極を形成する第２ガラス基板と、該第１および該第２ガラス基板の間隙に液晶材を封入してなる液晶パネルと、該液晶パネルの第１ガラス基板側に光を入射する光源と、該光源と該第１ガラス基板との間に設けた第１偏光子と、該液晶パネルの第２ガラス基板側を透過した光を投写するレンズと、該第２ガラス基板と該投写レンズとの間に設けた第２偏光子とからなる液晶投写ディスプレイにおいて、低反射率の膜を塗布した第３ガラス基板を該第２ガラス基板と投写レンズとの間に設けたことを特徴とする液晶投写形ディスプレイ。

【請求項７】請求項１ないし６のいずれか１項において、前記低反射膜を塗布した液晶パネル、第１偏光板、第２偏光板もしくは第３ガラス基板のいずれかを用いて成ることを特徴とする３板方式液晶投写形ディスプレイ。

【請求項８】請求項１ないし６のいずれか１項において、前記低反射膜を塗布した液晶パネル、第１偏光板、第２偏光板もしくは第３ガラス基板のいずれかを用いて成ることを特徴とする単板方式液晶投写形ディスプレイ。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は投写形テレビジョンに用いる液晶パネルに関わり、特にＴＦＴ（Thin－Film－Transistor:薄膜トランジスタ）を用いた液晶パネルで反射率が低い液晶パネルの構成に関する。

【０００２】

【従来の技術】液晶パネルを大別すると単純マトリクス液晶パネルとアクティブマトリクス液晶パネルの２種類に分けることが出来る。前者はＳＴＮ（Super－Twist－Nematic）の液晶材料を、単純な電極で挟んで駆動するＳＴＮ液晶パネルに代表される。後者はＴＮ（Twist－Nematic）の液晶材料を、ＴＦＴ（Thin－Film－Transistor：薄膜トランジスタ）のＯＮ／ＯＦＦスイッチ動作で駆動するＴＦＴ液晶パネルに代表される。画質的には後者のＴＦＴ液晶パネルの方が優れているが、大形液晶パネルを製作するのが困難である。このため、ＴＦＴ液晶パネルを用いて大形の画面を投写する投写形テレビの開発が盛んに行なわれている。この液晶パネルの構造およ

びこれを用いた投写形テレビの原理的な構成は、「フラットディスプレイ９１」（日経エレクトロニクス社　１９９１）に詳しい。

【０００３】液晶投写形ＴＶは、小形、軽量に加えて、光源の光量を大きくすることによって画面を明るくすることが比較的容易であるという特徴がある。投写画面を大形化すると必然的に投写画面が暗くなるため、並行して光源の光量を増大することが行われている。

【０００４】光源の光量を増大すると液晶パネルの内部に存在する薄膜トランジスタでの光リークが生じ易くなり、表示画面の黒と白の輝度比（コントラスト比）が低下する現象が見られる。この対策として、ＴＦＴを遮光する様にゲートの金属膜を広くしたり、ブラックマトリクス（以下ＢＭ）の面積を大きくしたりしている。

【０００５】

【発明が解決しようとする課題】これにより、光リークによるコントラスト低下は防げるが、反面、ゲート電極あるいはＢＭの金属面での不要光反射が増大し、微小面積でのコントラストの低下を誘引する。すなわち、白と黒の混在する画面では、液晶パネルの白の部分を透過した光が不要反射光となって黒の表示部分に飛びこみ、コントラストを著しく損なってしまう。

【０００６】不要反射光は液晶パネルの内部で生じるだけではなく、液晶パネルを透過した光がプリズム、投写レンズ等の光学部品で反射し、この光が再び液晶パネルの出射面で反射して生じる場合も少なくない。画質に悪影響を与える不要反射光はこの液晶パネルの出射面で生じる反射光が大部分である。

【０００７】この液晶パネル出射面で生じる不要反射光は、プリズム、投写レンズに多層コーティングを施すことにより光学部品での反射光を少なくして低減するのが一般的である。さらに、ＴＦＴのゲート電極、ＢＭを反射率の低い金属で構成するような方策も考えられている。しかし、反射率の低い金属、例えば酸化クロムなどはエッチングが困難な特殊な金属であって、通常のＴＦＴ形成プロセスでの扱いが容易でなく、また液晶パネルのガラス界面での反射光が残るなど完全ではない。従って、この液晶パネルの出射面で生じる不要反射光が、投写形液晶ディスプレイで高輝度、高コントラストの画面を実現する障害の一つになっていた。

【０００８】

【課題を解決するための手段】本発明ではこの液晶パネルの出射面での反射率を低減するため、液晶パネルの開口部形状および光の入射角度に応じたパターンで、液晶パネルの出射面側のガラス基板上に光を吸収するもしくは反射し難い低反射膜を、印刷あるいはリソグラフ等により塗布して形成する。あるいは、上記の低反射膜を塗布したガラス、偏光板を上記液晶パネルに密着して配置する。

【０００９】

【作用】プリズム、投写レンズなどの光学部品から反射してくる光は、上記の低反射膜にてほとんど吸収される。このため、液晶パネルの局所的に明るい表示部分を透過した光が投写レンズで反射しても、迷走光とはならず、他の暗い部分への不要反射光の影響は少なくなる。したがって、表示画面のコントラストは飛躍的に増大する。

【００１０】

【実施例】以下、本発明の実施例を図面を用いて詳細に説明する。

【００１１】図１は本発明の第１の実施例を示すための、３板液晶パネルを用いた液晶投写形ディスプレイの光学構成図である。

【００１２】図１の光学構成図は赤緑青（ＲＧＢ）３色の分光・合成にプリズムを用いた光学系の例であり、白色の光源１３、反射鏡１２、３色光分光プリズム１１、Ｂ用平面鏡１５a，１５b、Ｒ用平面鏡１４a，１４b、およびそれぞれ赤（Ｒ）、緑（Ｇ）、青（Ｂ）の添え字で区別した、フィールドレンズ５Ｒ，５Ｇ，５Ｂ、入射側の偏光板３Ｒ，３Ｇ，３Ｂ、低反射膜２Ｒ，２Ｇ，２Ｂ、液晶パネル１Ｒ，１Ｇ，１Ｂ、出射側の偏光板４Ｒ，４Ｇ，４Ｂ、３色光合成プリズム１０、投写レンズ１６から構成される。

【００１３】光源１３からの白色光は分光プリズム１１にてＲＧＢの３色に分光し、それぞれ、Ｒ光は平面鏡１４a，１４b、フィールドレンズ５Ｒ、偏光板３Ｒ、液晶パネル１Ｒ、低反射膜２Ｒ、偏光板４Ｒの経路を通り、Ｂ光は平面鏡１５a，１５b、フィールドレンズ５Ｂ、偏光板３Ｂ、液晶パネル１Ｂ、低反射膜２Ｂ、偏光板４Ｂの経路を通り、Ｇ光はフィールドレンズ５Ｇ、偏光板３Ｇ、液晶パネル１Ｇ、低反射膜２Ｇ、偏光板４Ｇの経路を通り、合成プリズム１０にて合成されたのち投写レンズ１６にて投写される。

【００１４】図２は、図１に示す液晶パネル１Ｒ，１Ｇ，１Ｂと低反射膜２Ｒ，２Ｇ，２Ｂとの関係を説明するための、画素の上面図（ａ）と断面図（ｂ）である。図２（ａ）の画素は信号を供給するドレイン線１３０a，１３０ｂと、ＴＦＴをオン、オフするゲート１２０a，１２０ｂと、ＴＦＴのチャンネルを構成するａ－Ｓｉ１４０と、ソース電極１５０と、画素電極１１０と、画素のＢＭ開口部１００から構成される。図２（ｂ）は、図２（ａ）の線ＬＭに添う断面図であり、ＴＦＴを積層する側のガラス基板２０１と、該ガラス基板２０１に対向して設けかつＢＭを積層する側のガラス基板２００と、該ガラス基板２００に積層する画素電極１３１a，１３１ｂ，１３１ｃおよび保護膜３０２、配向膜３０３と、該ガラス基板２００に積層するＢＭ膜１０１a，１０１ｂおよび対向電極３０１、配向膜３０４と、該配向膜３０３，３０４の間に封入した液晶層４００と、該ガラス基板２０１に塗布された低反射膜２０２a，２０２ｂから

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成る。

【００１５】なお、低反射膜２０２ａ，２０２ｂの形成方法としては、顔料系等の色素を印刷により塗布して形成する方法、あるいは光粘着剤をリソグラフィにてパターン化して部分的に粘着性を持たせた後これらの顔料系の色素を粘着させて形成する方法、顔料を混入して塗布したレジスト膜をリソグラフィによりパターン化して形成する方法などがある。これらの方法では色素を液晶パネルの外部に塗布するので、ＴＦＴあるいは液晶材への影響を考慮せずに、色素等の材質を選ぶことが可能である。

【００１６】図２（ｂ）に示す実施例ではガラス基板２００側から光線が入射するものとし、光線Ｉ1は、Ｉ2は入射光のうちの最も頻度の多い光線で代表する。低反射膜２０２ａおよび２０２ｂの配置は、それぞれＢＭ膜１０１ａの端Ａを通る光路で光線Ｉ1が低反射膜２０２ａの端Ｂに接し、ＢＭ膜１０１ｂの端Ｃを通る光路で光線Ｉ2が低反射膜２０２ｂの端Ｄに接するようにする。すなわち、ＢＭ膜１０１ａと低反射膜２０２ａとの重なり距離をＬ1およびそのＡＢ間の垂直距離をＤ1、またＢＭ膜1.01ｂと低反射膜２０２ｂとの重なり距離をＬ2およびそのＣＤ間の垂直距離をＤ2とすると、光線Ｉ1，Ｉ2の入射角θ1およびθ2とは

【００１７】

【数１】Ｌk≒ｔａｎθk×Ｄk　（但し　k=1，2）

の関係にある。プロジェクションディスプレイでの一例として入射角θ1≒５°、距離Ｄ1≒０．７㎜を用いると、Ｌ1≒６０μ程度である。

【００１８】この図２（ｂ）の配置は、ガラス基板２００側から入射してＢＭ膜１０１ａと１０１ｂとの開口部を通過する光に対しては低反射膜２０２ａと２０２ｂはほとんど影響を与えないが、投写光学系などから反射してガラス基板２０２側から入射する光に対しては低反射膜２０２ａと２０２ｂが吸収体となり、不要光の反射を低減することが出来るという効果がある。

【００１９】上記の数１と無関係に低反射膜２０２ａと２０２ｂをガラス基板２０１に塗布した場合でも、不要光の反射を低減する効果があるが、ガラス基板２００側から入射してＢＭ膜１０１ａと１０１ｂとの開口部を通過する光に対して低反射膜２０２ａと２０２ｂが吸収体となり実質的な開口率が低下する。従って、このＢＭ膜１０１ａ，１０１ｂと低反射膜２０２ａ，２０２ｂとは相似パターンであって、そのパターンの縁が揃う様な位置関係とすることで簡単に不要光を低減できる効果がある。更に、厳密には入射光の入射角度によって以下に説明するようにＢＭ膜１０１ａ，１０１ｂと低反射膜２０２ａ，２０２ｂとの位置関係を変えなければならない。以下、図３～図８を用いて入射角度が異なる場合の位置関係の実施例について説明する。

【００２０】図３は、液晶パネルへの入射光が収束光であって、それぞれ液晶パネルの左端（Ｌ）、中央（Ｃ）、右端（Ｒ）における光線ＩＬ，ＩＣ，ＩＲの入射角θが液晶パネルの中央でθＣ（＝垂直）、左端でθＬ、右端でθＲである場合の実施例について、ＢＭ膜１０１－1～１０１－nと低反射膜２０２－1～２０２－nとの位置関係の一例を説明するための、液晶パネルの断面図である。なお、同一構成要素で場所が異なるものについては、配列画素の番号による添え字1～n、もしくは左端（Ｌ）、中央（Ｃ）、右端（Ｒ）の添え字で区別し、前者についてはＢＭ膜１０１－1～１０１－n、低反射膜２０２－1～２０２－nのごとく表記し、後者についてはＴＦＴ用のガラス基板２０１Ｌ，２０１Ｃ，２０１ＲあるいはＢＭ用のガラス基板２００Ｌ，２００Ｃ，２００Ｒと表記した。

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【００２１】図３においては、液晶パネル左端におけるＢＭ膜１００－1の右端面ＡＬと低反射膜２０２－1の右端面ＢＬとの重なり距離をＬＬ＝｜ＢＬ－ＡＬ｜、液晶パネル中央におけるＢＭ膜１００－(i+1)の左端面ＡＣと低反射膜２０２－(i+1)の左端面ＢＣとの重なり距離をＬＣ＝｜ＢＣ－ＡＣ｜、液晶パネル右端のＢＭ膜１００－nの左端面ＡＲと低反射膜２０２－nの左端面ＢＲとの重なり距離をＬＲ＝｜ＢＲ－ＡＲ｜とし、入射光線ＩＬ，ＩＣ，ＩＲの入射角θＬ，θＣ＝９０°，θＲとの関係が、次の数式

【００２２】

【数２】

Ｌk≒ｔａｎθk×Ｄk　（但し　k=Ｌ，Ｃ，Ｒ　）

を満たすように低反射膜２０２－1～２０２－nを配置する。すなわち、図３の液晶パネル中央においては光線ＩＣが垂直に入射するのでＬＣ≒０であり、液晶パネル左端ではＢＬ－ＡＬ＝ＬＬ＞０（低反射膜２０２－1の右端ＢＬがはみ出している）、液晶パネル右端ではＢＲ－ＡＲ＝ＬＲ＞０（低反射膜２０２－nの左端ＢＲの方がはみ出している）である。

【００２３】なお、低反射膜２０２－1～２０２－nあるいはＢＭ膜１０１－1～１０１－nの端面であって上記記載とは逆の端面同士の関係、例えば上記図３の説明における「液晶パネル中央におけるＢＭ膜１００－(i+1)の左端面ＡＣと低反射膜２０２－(i+1)の左端面ＢＣとの関係」に対して逆の端面同士の関係である「液晶パネル中央におけるＢＭ膜１００－(i+1)の右端面と低反射膜２０２－(i+1)の右端面の関係」については、液晶パネルの両端を除いて、はみ出しの関係が逆になることは図３より自明である。

【００２４】図４は、入射光が収束光であって、それぞれ液晶パネルの左端（Ｌ）、中央（Ｃ）、右端（Ｒ）における光線ＩＬ，ＩＣ，ＩＲの入射角θが液晶パネルの中央でθＣ、左端でθＬ、右端でθＲ（＝垂直）である場合の実施例について、ＢＭ膜１０１－1～１０１－nと低反射膜２０２－1～２０２－nとの関係を説明するための、液晶パネルの断面図である。なお、図３と同一構成部品

については同じ番号を付した。

【００２５】図４においても、液晶パネル左端のＢＭ膜１００－1の右端面ＡＬと低反射膜２０２－1の右端面ＢＬとの重なり距離をＬＬ、液晶パネル中央のＢＭ膜１００－(i+1)の左端面ＡＣと低反射膜２０２－(i+1)の左端面ＢＣとの重なり距離をＬＣ、液晶パネル右端のＢＭ膜１００－nの左端面ＡＲと低反射膜２０２－nの左端面ＢＲとの重なり距離をＬＲとして、それぞれ入射光線ＩＬ，ＩＣ，ＩＲの入射角θＬ，θＣ，θＲ＝９０°との関係が、上記数２を満たすように低反射膜２０２－1～２０２－nを配置する。すなわち、図４の右端においては光線ＩＲが垂直に入射するのでＬＲ≒０であり、中央ではＡＣ－ＢＣ＝ＬＣ＞０（ＢＭ膜１０１－(i+1)の左端ＡＣの方がはみ出している）、左端ではＢＬ－ＡＬ＝ＬＬ＞０（低反射膜２０２－1の右端ＢＬがはみ出している）である。

【００２６】なお、入射光が収束光であって、液晶パネル左端において垂直に入射する場合の実施例については、図４で示す関係が左右逆になるだけである。

【００２７】図５は、液晶パネルへの入射光が発散光であって、それぞれ液晶パネルの左端（Ｌ）、中央（Ｃ）、右端（Ｒ）における光線ＩＬ，ＩＣ，ＩＲの入射角θが液晶パネルの中央で垂直、左端でθＬ、右端でθＲと異なる場合の実施例について、ＢＭ膜１０１－1～１０１－nと低反射膜２０２－1～２０２－nとの関係を説明するための、液晶パネルの断面図である。

【００２８】図５においても、液晶パネル左端のＢＭ膜１００－1の右端面ＡＬと低反射膜２０２－1の右端面ＢＬとの重なり距離をＬＬ、液晶パネル中央のＢＭ膜１００－(i+1)の左端面ＡＣと低反射膜２０２－(i+1)の左端面ＢＣとの重なり距離をＬＣ、液晶パネル右端のＢＭ膜１００－nの左端面ＡＲと低反射膜２０２－nの左端面ＢＲとの重なり距離をＬＲとして、それぞれ入射光線ＩＬ，ＩＣ，ＩＲの入射角θＬ，θＣ＝９０°，θＲとの関係が、上記数２を満たすように低反射膜２０２－1～２０２－nを配置する。すなわち、図５の液晶パネル中央においては光線ＩＣが垂直に入射するのでＬＣ≒０であり、液晶パネル左端ではＡＬ－ＢＬ＝ＬＬ＞０（ＢＭ膜１０１－1の右端ＡＬがはみ出している）、液晶パネル右端ではＡＲ－ＢＲ＝ＬＲ＞０（ＢＭ膜１０１－Ｎの左端ＡＬの方がはみ出している）である。

【００２９】図６は、液晶パネルへの入射光が平行光であって、それぞれ液晶パネルの左端（Ｌ）、中央（Ｃ）、右端（Ｒ）における光線ＩＬ，ＩＣ，ＩＲの入射角θＬ，θＬ，θＲがいずれも９０°である場合の実施例について、ＢＭ膜１０１－1～１０１－nと低反射膜２０２－1～２０２－nとの関係を説明するための、液晶パネルの断面図である。

【００３０】図６においても、液晶パネル左端のＢＭ膜１００－1の右端面ＡＬと低反射膜２０２－1の右端面ＢＬとの重なり距離をＬＬ、液晶パネル中央のＢＭ膜１００－(i+1)の左端面ＡＣと低反射膜２０２－(i+1)の左端面ＢＣとの重なり距離をＬＣ、液晶パネル右端のＢＭ膜１００－nの左端面ＡＲと低反射膜２０２－nの左端面ＢＲとの重なり距離をＬＲとすると、それぞれ入射光線ＩＬ，ＩＣ，ＩＲの入射角θＬ＝θＣ＝θＲ＝９０°との関係が、上記数２を満たすように低反射膜２０２－1～２０２－nを配置する。すなわち、図６の液晶パネルにおいてはいずれの光線も垂直に入射するのでＬＣ≒ＬＬ≒ＬＲ≒０であって、ＢＭ膜１０１－1～１０１－nと低反射膜２０２－1～２０２－nの端面はいずれもほぼ揃うように配置している。

【００３１】図７は、液晶パネルへの入射光が平行度の悪い平行光であって、それぞれ液晶パネルの左端（Ｌ）、中央（Ｃ）、右端（Ｒ）では、平均として垂直に入射するが、図面左斜め上からはそれぞれ光線ＩＬ，ＩＣ，ＩＲの入射光となり、右斜め上からはそれぞれ光線ＩＬ’，ＩＣ’，ＩＲ’の入射光であり、そのばらつきがそれぞれθＬ，θＬ，θＲおよびθＬ’，θＬ’，θＲ’である場合の実施例について、ＢＭ膜１０１－1～１０１－nと低反射膜２０２－1～２０２－nとの関係を説明するための、液晶パネルの断面図である。

【００３２】図７においても、液晶パネル左端のＢＭ膜１００－1の右端面ＡＬと低反射膜２０２－1の右端面ＢＬとの重なり距離をＬＬ、液晶パネル中央のＢＭ膜１００－(i+1)の左端面ＡＣと低反射膜２０２－(i+1)の左端面ＢＣとの重なり距離をＬＣ、液晶パネル右端のＢＭ膜１００－nの左端面ＡＲと低反射膜２０２－nの左端面ＢＲとの重なり距離をＬＲとして、それぞれ入射光線ＩＬ’，ＩＣ，ＩＲの入射角との関係が、上記数２を満たすように低反射膜２０２－1～２０２－nを配置する。すなわち、

【００３３】

【数３】ＬＫ ≒ ｔａｎθＫ’× ＤＫ　（但し　ｋ＝Ｌ）

【００３４】

【数４】

Ｌｋ ≒ ｔａｎθｋ × Ｄｋ　（但し　ｋ＝Ｃ，Ｒ）

となるように低反射膜２０２－1～２０２－nを配置する。これは、ＢＭ膜１０１－1～１０１－nと低反射膜２０２－1～２０２－nの端面の関係は、それぞれの右端面の関係については右斜め上からの入射光線ＩＬ’，ＩＣ’，ＩＲ’の入射角θＬ’，θＬ’，θＲ’を用いた上記数３にしたがい、左端面の関係については左斜め上からの入射光線ＩＬ，ＩＣ，ＩＲの入射角θＬ，θＬ，θＲを用いた上記数４に従うことを意味する。この結果、いずれのＢＭ膜１０１－1～１０１－nの端面も低反射膜２０２－1～２０２－nの端面よりもはみ出す構造となる。

【００３５】図８は、液晶パネルへの入射光が平行度の悪い平行光であって、それぞれ液晶パネルの左端（Ｌ）、中央（Ｃ）、右端（Ｒ）では平均として垂直に入射するが、図面左斜め上からはそれぞれ光線ＩＬ，ＩＣ，ＩＲの入射光となり、右斜め上からはそれぞれ光線Ｉ

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L'，IC'，IR'の入射光であり、そのばらつきがそれぞれθL，θL，θRおよびθL'，θL'，θR'である場合の実施例について、BM膜１０１－1～１０１－nと低反射膜２０２－１～２０２－nとの関係が図７と異なる実施例を説明するための、液晶パネルの断面図である。

【００３６】図８においても、液晶パネル左端のBM膜１００－1の右端面ALと低反射膜２０２－1の右端面BLとの重なり距離をLL、液晶パネル中央のBM膜１００－(i+1)の左端面ACと低反射膜２０２－(i+1)の左端面BCとの重なり距離をLC、液晶パネル右端のBM膜１００－nの左端面ARと低反射膜２０２－nの左端面BRとの重なり距離をLRとして、それぞれ入射光線IL，IC'，IR'の入射角との関係が、上記数２を満たすように低反射膜２０２－1～２０２－nを配置する。すなわち、

【００３７】

【数５】LK ≒ tanθK × DK　（但し　k=L）

【００３８】

【数６】

Lk ≒ tanθk'× Dk　（但し　k=C，R　）

である。これは、BM膜１０１－1～１０１－nと低反射膜２０２－1～２０２－nの端面の関係は、それぞれの右端面の関係については左斜め上からの入射光線IL，IC，IRの入射角θL，θL，θRを用いた上記数５にしたがい、左端面の関係については右斜め上からの入射光線IL'，IC'，IR'の入射角θL'，θL'，θR'を用いた上記数６に従うことを意味する。この結果、いずれの低反射膜２０２－1～２０２－nの端面もBM膜１０１－1～１０１－nの端面よりもはみ出す構造となる。この低反射膜２０２－1～２０２－nとBM膜１０１－1～１０１－nとの端面の位置関係は、図７に示す位置関係とは逆である。

【００３９】上記図２から図８までの説明は、図１の液晶パネル１R，１G，１Bとして図２に示すようにBM側のガラス基板２００から光が入射する構造の液晶パネルを用いた場合の実施例である。光の入射としてTFT側のガラス基板２０１から入射することも考えられ、この場合の実施例を図９に示す。

【００４０】図９は、光入射がTFT側のガラス基板２０１側から入射する場合のBM膜１０１a，１０１bと低反射膜２０２a，２０２bとの関係を説明するための画素の断面図である。図８の構成要素は図２（b）と同じであり、TFTを積層する側のガラス基板２０１と、該ガラス基板２０１に対向して設けかつBMを積層する側のガラス基板２００と、TFT側のガラス基板２０１に積層する画素電極１３１a，１３１b，１３１cおよび保護膜３０２、配向膜３０３と、BM側のガラス基板２００に積層するBM膜１０１a，１０１bおよび対向電極対向電極３０１、配向膜３０４と、該配向膜３０

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３，３０４の間に封入した液晶層４００とからなるが、光線I1，I2がTFT側のガラス基板２０１から入射する点および低反射膜２０２a，２０２bを該ガラス基板２００に塗布している点が図２（b）と異なる。

【００４１】図９に示す実施例でも図２と同じ様に、低反射膜の２０２aおよび２０２bの配置は、それぞれBM膜１０１aの端を通る光路で光線I1が低反射膜２０２aの端に接し、BM膜１０１bの端を通る光路で光線I2が低反射膜２０２bの端に接するようにする。すなわち、BM膜１０１aと低反射膜２０２aとの重なり距離をL1およびそのAB間の距離をD1、またBM膜１０１bと低反射膜２０２bとの重なり距離をL2およびそのCD間の距離をD2とすると、光線I1，I2の入射角θ1およびθ2は前述の数１を満たす。

【００４２】図１０は、図９に示す画素構造を有する液晶パネル全面でのBM膜１０１－1～１０１－nと低反射膜２０２－1～２０２－nとの端面の関係の一例を示す液晶パネルの断面図である。図１０の構成要素は図３～図８と同じであるが、低反射膜２０２－1～２０２－nがBM側のガラス基板２００L，２００C，２００Rに塗布している点だけが異なっている。

【００４３】図１０におけるBM膜１０１－1～１０１－nと低反射膜２０２－1～２０２－nとの端面の関係は、液晶パネルへの入射光が理想的に平行光である場合の実施例であり、前述の図６に示す入射光の場合と同じである。同様に、入射光が平行光でない場合におけるBM膜１０１－1～１０１－nと低反射膜２０２－1～２０２－nとの端面の関係は図３～図５、図７、図８と同様に説明できることは明らかである。

【００４４】図１１は本発明の第２の実施例を示すための、３板液晶パネルを用いた液晶投写形ディスプレイの光学構成図である。図１１の光学構成図は、図１に示す光学構成と同様に赤緑青（RGB）３色の分光・合成にプリズムを用いた光学系の例であるが、図１のうち白色の光源１３、反射鏡１２、３色光分光プリズム１１、B用平面鏡１５a，１５b、R用平面鏡１４a，１４bを省略して示した。

【００４５】図１１に示す実施例では、液晶パネル１R，1G，1Bと出射側の偏光板４R，４G，４Bとの間に補助のガラス基板６R，６G，６Bを設け、低反射膜２R，２G，２Bは該補助ガラス基板６R，６G，６Bに塗布している。

【００４６】図１２は、図１１に示す光学配置で、液晶パネル全面にわたるBM膜１０１－1～１０１－nと低反射膜２０２－1～２０２－nとの端面の関係の一例を示す断面図である。図１２の構成要素は大部分が図３～図８と同じであるが、低反射膜２０２－1～２０２－nが補助ガラス基板２０６L，２０６C，２０６Rに塗布している点だけが異なっている。なお、補助ガラス基板２０６L，２０６C，２０６Rには偏光板２０４L，２０４

C，２０４Ｒも粘着しているものとしてこれら偏光板２０４Ｌ，２０４Ｃ，２０４Ｒも示した。

【００４７】図１２についても入射光が理想的に平行光である場合の実施例であり、ＢＭ膜１０１－1～１０１－nと低反射膜２０２－1～２０２－nとの端面の関係は、前述の図６に示す入射光の場合での端面の関係と同じである。同様に、入射光が平行光でない場合におけるＢＭ膜１０１－1～１０１－nと低反射膜２０２－1～２０２－nとの端面の関係も図３～図５、図７、図８と同様である。

【００４８】図１３は本発明の第３の実施例を示すための、３板液晶パネルを用いた液晶投写形ディスプレイの光学構成図である。図１３の光学構成図は、図１１に示す光学構成と同様に、図１のうち白色の光源１３、反射鏡１２、３色光分光プリズム１１、Ｂ用平面鏡１５a，１５b、Ｒ用平面鏡１４a，１４bを省略した光学構造を示している。

【００４９】図１３に示す実施例では、液晶パネル１Ｒ，１Ｇ，１Ｂに出射側の偏光板４Ｒ，４Ｇ，４Ｂを貼付し、低反射膜２Ｒ，２Ｇ，２Ｂは該偏光板４Ｒ，４Ｇ，４Ｂに塗布している。

【００５０】図１４は、図１３に示す光学配置で、液晶パネル全面にわたるＢＭ膜１０１－1～１０１－nと低反射膜２０２－1～２０２－nとの端面の関係の一例を示す断面図である。図１２の構成要素は大部分が図３～図８と同じであるが、ガラス基板２０１Ｌ，２０１Ｃ，２０１Ｒに偏光板２０４Ｌ，２０４Ｃ，２０４Ｒを貼り付け、低反射膜２０２－1～２０２－nを該偏光板２０４Ｌ，２０４Ｃ，２０４Ｒに塗布している点が異なっている。

【００５１】図１４についても入射光が理想的に平行光である場合の実施例であり、ＢＭ膜１０１－1～１０１－nと低反射膜２０２－1～２０２－nとの端面の関係は、前述の図６に示す入射光の場合での端面の関係と同じである。同様に、入射光が平行光でない場合におけるＢＭ膜１０１－1～１０１－nと低反射膜２０２－1～２０２－nとの端面の関係も図３～図５、図７、図８と同様である。

【００５２】図１５は本発明の第４の実施例を示すための、３板の液晶パネルを用いた反射方式液晶投写形ディスプレイの光学構成図である。図１５の光学構成図は、図１３に示す光学構成に一部分が類似するが、図１３の偏光板３Ｒ，３Ｇ，３Ｂの代わりに平面反射鏡８Ｒ，８Ｇ，８Ｂを設け、また、光源１３からの光を２分波するハーフミラー７を新たに設けた点が図１３の構成と大きく異なる。すなわち、光源１３からの光をハーフミラー７にて２分波した半分がダイクロイックプリズム１１に入射してＲ，Ｇ，Ｂの光に分光し、そのうちＲ光は、低反射膜２Ｒ、偏光板３Ｒ、液晶パネル１Ｒを通り、平面反射鏡８で反射したのち逆の経路でダイクロイックプリズム１１に入射する。他の、Ｇ光、Ｂ光についても同様である。こうして戻ってきたＲ光、Ｇ光、Ｂ光は合成プリズム１１にて合成されたのち、ハーフミラー７を通過して投写レンズ１６にて投写される。

【００５３】図１５に示す構成は、図１３と同様に低反射膜２Ｒ、低反射膜２Ｇ、低反射膜２Ｂがそれぞれ偏光板３Ｒ、偏光板３Ｇ、偏光板３Ｂに塗布された構造であり、ＢＭ膜１０１－1～１０１－nと低反射膜２０２－1～２０２－nとの端面との位置関係は図１４の説明と同様である。

【００５４】図１６は本発明の第５の実施例を示すための、単板の液晶パネルを用いた液晶投写形ディスプレイの光学構成図である。図１６の構成は光源１３、反射境１２、偏光板３、液晶パネル１’、偏光板４、低反射膜２、投写レンズ１６からなる。図１６の単板投写形ディスプレイでは、液晶パネル１’はカラー液晶パネルである点が上記図１～図１５に示すモノクロの液晶パネル１と異なるが、低反射膜２が偏光板３に塗布された構造であるのは図１３と同様であり、したがってＢＭ膜１０１－1～１０１－nと低反射膜２０２－1～２０２－nとの端面との関係は位置関係は図１４の説明と同様である。

【００５５】

【発明の効果】以上の本発明の実施例の説明により、液晶パネルの開口部形状および光の入射角度に応じたパターンで、液晶パネルの出射面側のガラス基板上に光を吸収するもしくは反射し難い低反射膜を印刷もしくは塗布等により形成し、あるいは、上記の低反射膜を印刷したガラス、偏光板を上記液晶パネルに密着して配置することにより、プリズム、投写レンズなどの光学部品から反射してくる光が、上記の低反射膜にてほとんど吸収されため、液晶パネルの表示部に部分的に明るい画面があってこの部分を透過した光が投写レンズで反射することがあっても、迷走光とはならず、他の暗い部分への不要反射光の影響は少なくり、表示画面のコントラストは飛躍的に増大するという効果がある。

【図面の簡単な説明】

【図１】本発明の第１の実施例を示すための、３板液晶パネルを用いた液晶投写形ディスプレイの光学構成図である。

【図２】図１に示す実施例の効果を説明するための画素の上面図（ａ）と断面図（ｂ）である。

【図３】図２で入射光が収束光である場合のＢＭ膜と低反射膜との位置関係を説明するための液晶パネルの断面図である。

【図４】図２で入射光が収束光である場合のＢＭ膜と低反射膜との位置関係を説明するための液晶パネルの断面図である。

【図５】図２で入射光が発散光である場合のＢＭ膜と低反射膜との位置関係を説明するための液晶パネルの断面図である。

【図６】図２で入射光が平行光である場合のＢＭ膜と低

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反射膜との位置関係を説明するための液晶パネルの断面図である。

【図７】図２で入射光が平行度の悪い平行光である場合のＢＭ膜と低反射膜との位置関係を説明するための液晶パネルの断面図である。

【図８】図２で入射光が平行度の悪い平行光である場合のＢＭ膜と低反射膜との位置関係を説明するための液晶パネルの断面図である。

【図９】ＴＦＴ側基板から光入射する場合の液晶パネルと低反射膜との関係を説明するための画素の断面図である。

【図１０】図９に示す画素構造を有する液晶パネルのＢＭ膜と低反射膜との関係を説明するための液晶パネルの断面図である。

【図１１】本発明の第２の実施例を示すための３板液晶パネルを用いた液晶投写形ディスプレイの光学構成図である。

【図１２】図１１の液晶パネルでＢＭ膜と低反射膜との関係の説明するための液晶パネルの断面図である。

【図１３】本発明の第３の実施例を示すための３板液晶パネルを用いた液晶投写形ディスプレイの光学構成図である。

【図１４】図１３の液晶パネルでＢＭ膜と低反射膜との関係を説明するための液晶パネルの断面図である。

【図１５】本発明の第４の実施例を示すための３板の液晶パネルを用いた反射方式液晶投写形ディスプレイの光学構成図である。

【図１６】本発明の第５の実施例を示すための単板の液晶パネルを用いた液晶投写形ディスプレイの光学構成図である。

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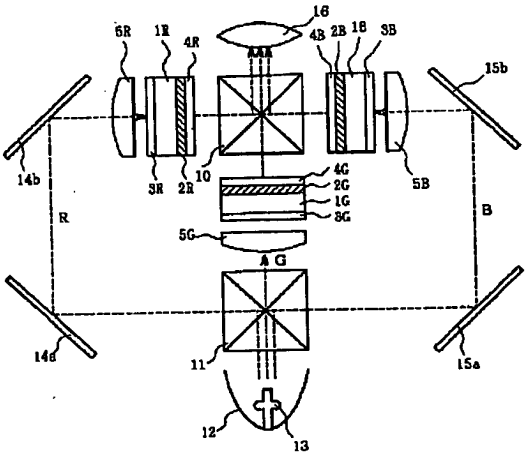
【符号の説明】

１３…白色の光源、
１２…反射鏡、
１１…３色光分光プリズム、
１５a，１５b…Ｂ用平面鏡、
１４a，１４b…Ｒ用平面鏡、
5R，5G，5B…フィールドレンズ、
3R，3G，3B…偏光板、
2R，2G，2B…低反射膜、
1R，1G，1B…液晶パネル、
4R，4G，4B…偏光板、
１０３…色光合成プリズム、
１６…投写レンズ、
１３０a，１３０b…ドレイン線、
１２０a，１２０b…ゲート、
１４０…a－Ｓｉ、
１５０…ソース電極、
１１０…画素電極、
１００…ＢＭ開口部、
２００，２０１…ガラス基板、
１３１a，１３１b，１３１c…画素電極、
３０２…保護膜、
３０３…配向膜、
１０１a，１０１b…ＢＭ膜、
３０１…対向電極、
３０４…配向膜、
４００…液晶層、
２０２a，２０２b…低反射膜、
１０１－1～１０１－n…ＢＭ膜、
２０２－1～２０２－n…低反射膜。

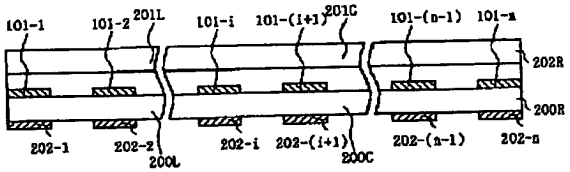
【図１】

図 1



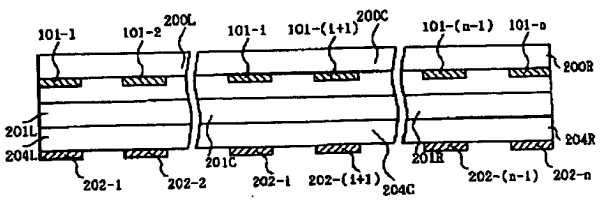
【図１０】

図 10



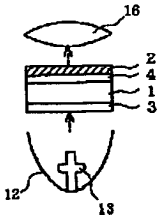
【図１４】

図 14



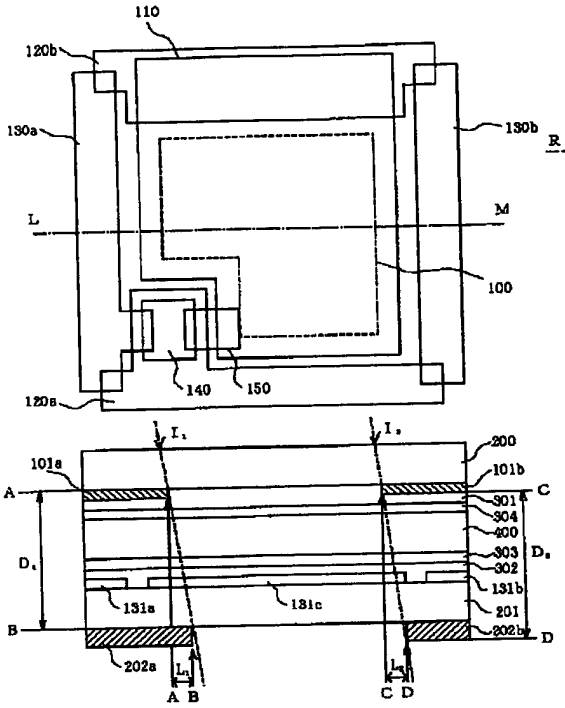
【図１６】

図 16



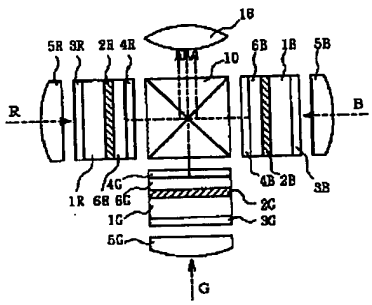
【図２】

図 2



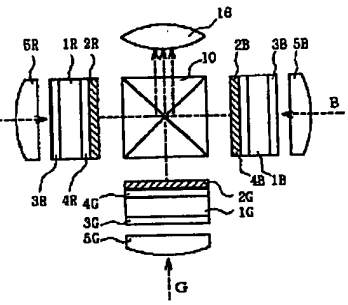
【図１１】

図 11



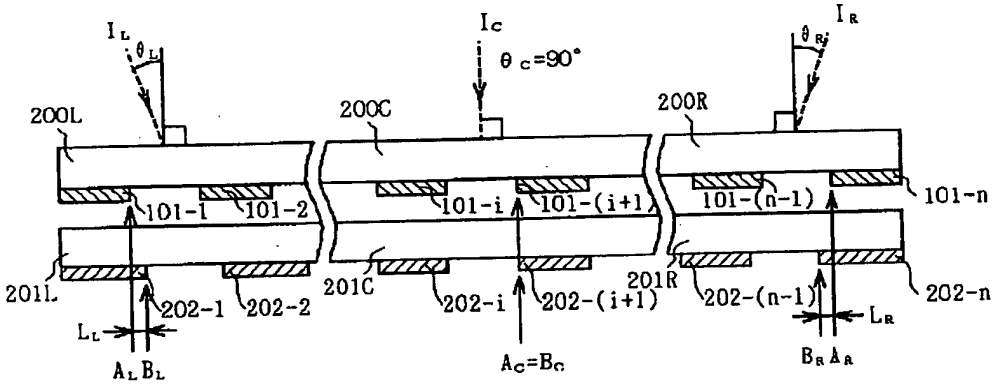
【図１３】

図 13



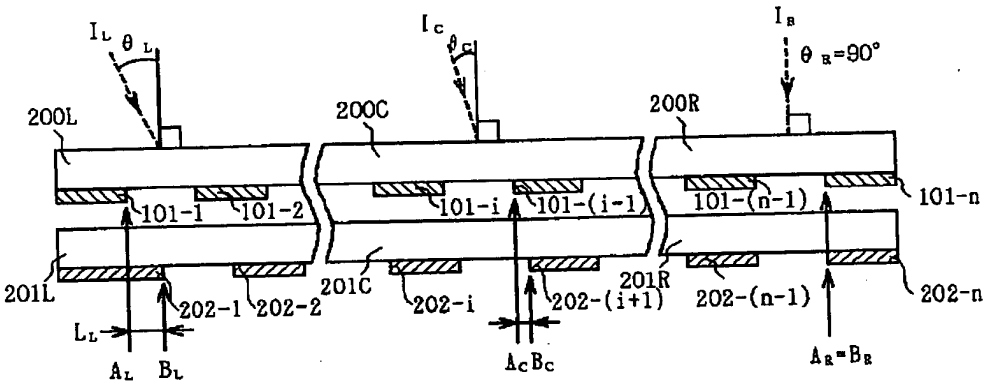
【図３】

図 3



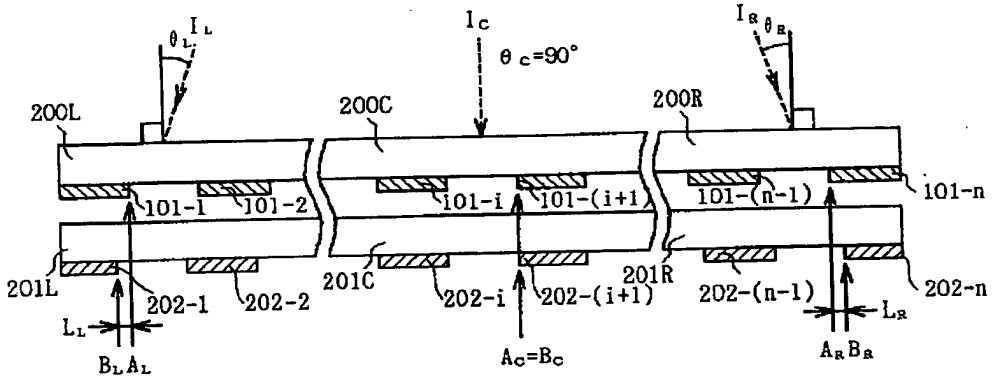
【図４】

図 4



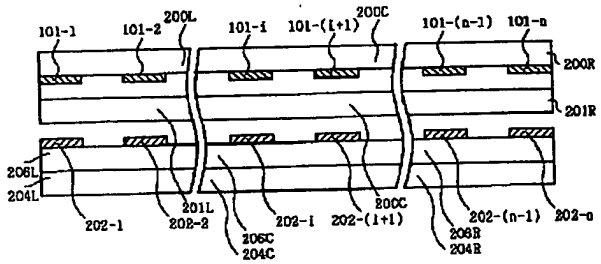
【図５】

図 5



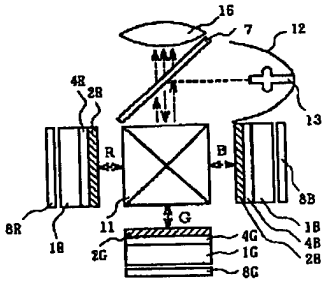
【図１２】

図 12



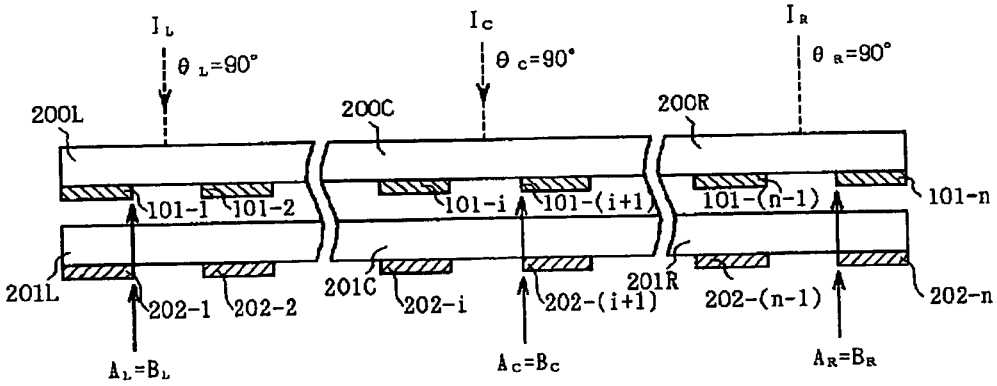
【図１５】

図 15



【図6】

図 6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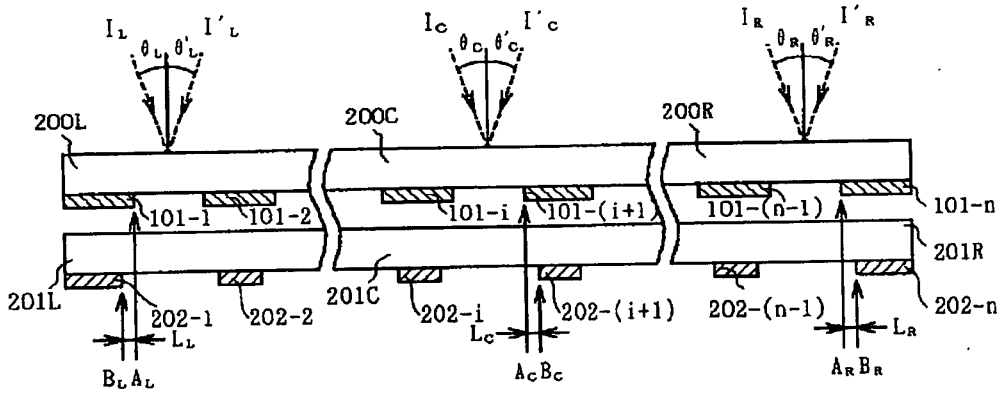
θ_L=90°
I_C
θ_C=90°
I_R
θ_R=90°
200L
200C
200R
101-1
101-2
101-i
101-(i+1)
101-(n-1)
101-n
201L
201C
201R
202-1
202-2
202-i
202-(i+1)
202-(n-1)
202-n
A_L=B_L
A_C=B_C
A_R=B_R

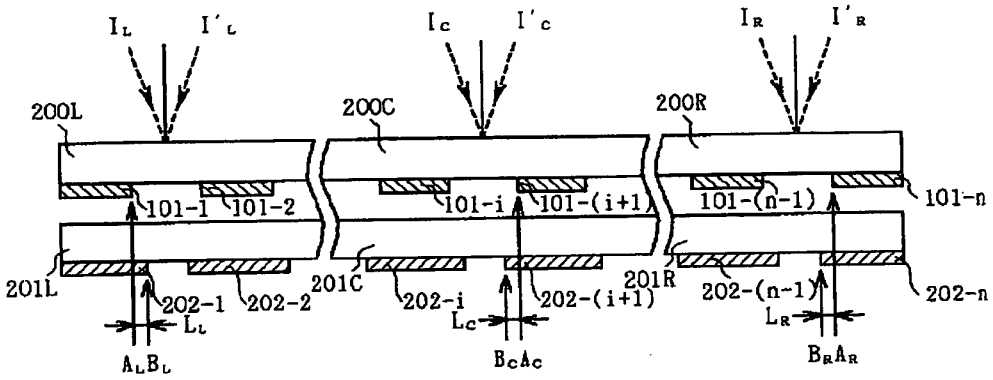
【図7】

図 7


I_L
I'_L
θ_L
θ'_L
I_C
I'_C
θ_C
θ'_C
I_R
I'_R
θ_R
θ'_R
200L
200C
200R
101-1
101-2
101-i
101-(i+1)
101-(n-1)
101-n
201L
201C
201R
202-1
202-2
202-i
202-(i+1)
202-(n-1)
202-n
L_L
L_C
L_R
B_L A_L
A_C B_C
A_R B_R

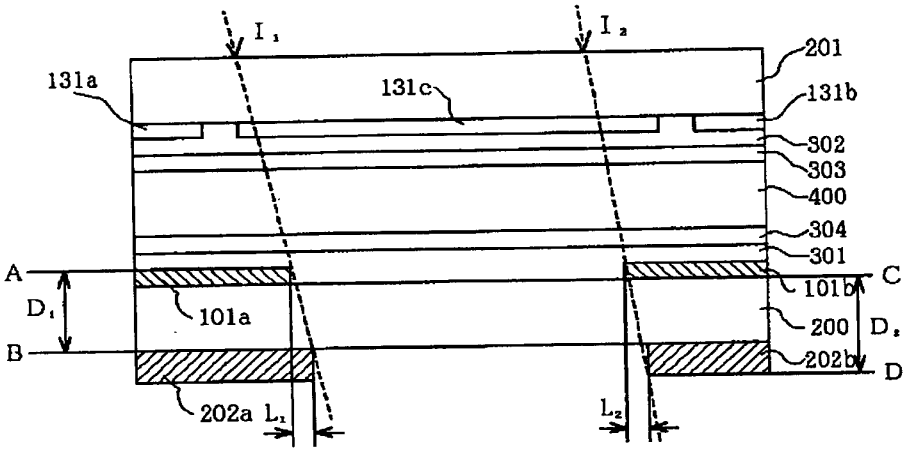
【図8】

図 8



【図9】

図 9



フロントページの続き

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